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CONSUMER PERCEPTIONS OF SUSTAINABLE FARMING PRACTICES: A BEST-WORST SCENARIO

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ABSTRACT

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The ability of a firm to differentiate their product hinges critically on an accurate understanding of the perceptions consumers hold regarding the implications of a credence labeling claim. Building upon existing work evaluating other food attribute labels (e.g., genetically-modified products, region of origin, use of growth hormones) and the impact of consumer inferences (e.g., implicit associations made from explicitly provided information), this work begins to address gaps in the literature regarding food products with sustainably produced claims. This paper uses data collected in the summer and fall of 2010 from a national, web-based survey of 1002 households, to initiate the process of examining consumer inferences and valuations of food products making sustainably produced claims. A Best-Worst scaling framework was implemented to identify what consumers believe sustainably produced labels mean and their preferences for each of the sustainable farming practices considered. The best-worst survey method forces respondents to make trade-offs by simultaneously choosing the most and least preferred attributes. The measured level of concern can then be applied to a standardized ratio scale. The results of this study suggest that consumers perceive farm size and local production as highly important elements of sustainable agriculture. Additionally, consumer preferences over economic attributes such as consumer food prices and financial stability of farmers exhibit high heterogeneity, indicating segmentation in the sample and potential for targeted marketing management.

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KEY TO ABBREVIATIONS

Table 1: Apple Sustainable Farming Attribute Key

I.D.	Attribute
GC	Ground Cover and Area Management Practices are Employed
FN	Fertilizer and Nutrient Materials are Used Minimally
CP	Little to No Chemical Pesticides are Used for Pest Management
CH	Little to No Chemical Herbicides are Used for Weed Management
PM	Pollinator Management is Employed
OP	Other Pests are Controlled using Preventative Measures, and Habitat Controls
FS	Farm Size is Small and Corporate Involvement is Limited
PL	Production, Distribution, and Sale is Done Locally
CFP	Consumer Food Prices are Affordable
FF	Farmers are Financially Stable

Table 2: Beef Sustainable Farming Attribute Key

I.D.	Attribute
SA	Prohibited Use of Sub-therapeutic Antibiotics
GH	Prohibited Use of Growth Hormones
GM	Prohibited Use of Genetically Modified Livestock
AS	Animal Health and Safety are Protected
PF	Feed is Pasture Based and Waste Management Systems Employed
OP	Pests are Controlled Using Preventative Measures, Cultural and Nutritional Controls
FS	Farm Size is Small and Corporate Involvement is Limited
PL	Production, Distribution, and Sale is Done Locally
CFP	Consumer Food Prices are Affordable
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Introduction

Food produced using sustainable production practices is receiving increasing attention in both public and private arenas. More food products are being marketed using sustainable or sustainably produced certification claims for differentiation. As "sustainably produced" food gains market momentum, questions arise regarding what consumers perceive when faced with sustainably produced labels. Moreover, what is the corresponding demand for products making such claims? The viability and contribution of farms to food system sustainability has begun to rely on the exploitation of high-value niche markets for their products, as previously done with organic. Before investing heavily in "sustainably produced" labeling schemes, consumer perceptions about sustainably produced foods, their willingness-to-pay for such products and the degree to which perceptions and price premiums can be altered by information about sustainable production practices need to be better understood.

Relatively few economic studies have focused on sustainability attributes in the context of agricultural production practices. Previously, Callens and Tyteca (1999) used a framework for evaluating the productive efficiency of agricultural firms in the context of overall sustainability using economic, social and environmental metrics. A similar three pronged foundational approach to sustainability is followed here. In a similar study conducted in the UK, Clonan et. al. (2010) have used seven guiding sustainability principles to assess consumer's priorities toward sustainable foods. Most recently, Santimanon and Weatherspoon (2010) used hedonic analysis to determine price premiums of sustainable attributes for fresh eggs. Additionally, Saunders et. al. (2010) have investigated consumer purchasing decisions toward sustainability claims on food in the context of carbon emissions reduction.

Within this limited literature on sustainability, very little of the research has focused on consumer perceptions and corresponding demand for sustainable production practices and resulting food products. Tonsor and Shupp (2009) conducted preliminary analysis on consumer perceptions of sustainably produced food labels, the results of which have informed the background for this study. Consumer preferences and willingness-to-pay for sustainable labeling in the context of farm production practices has been considered by Umberger et al. (2002) in the context of corn versus grass-fed beef, and Onozaka, Nurse, and McFadden (2010) and Onozaka and McFadden (2011) in the context of fresh produce.

The core objective of this research is to initiate the process of examining consumer inferences and valuations of food products making sustainably produced claims. This analysis aims to first identify what consumers believe sustainably produced labels mean and to determine the relative importance of such attributes to the labeling scheme. Secondly, it aims to determine which attributes drive consumer segments for application in targeted marketing of sustainable food production practices.

"Sustainably produced is an attribute that, as of now, has no absolute definition and is thus much more open to consumer perceptions. In the context of our study, the fact that there is no absolute definition raises the question, what do consumers infer from claims of sustainably produced? As noted by Darby et al. (2008) in their evaluation of locally

produced foods, the ability of a firm to differentiate their product hinges critically on an accurate understanding of the perceptions consumers hold regarding what a credence labeling claim implies. Building upon existing work evaluating other food attribute labels (e.g., genetically-modified products, region of origin, use of growth hormones) and the impact of consumer inferences (e.g., implicit associations made from explicitly provided information), we seek to address gaps in the literature regarding food products with sustainably produced claims.

Research Methodology

A national, web-based survey of 1002 households was developed to collect the data used for this analysis in the summer and fall of 2010. 502 of the respondents are residents of Michigan, while the remaining 500 households are drawn randomly from the other 49 states. Michigan exhibits great agricultural diversity in the variety of fruit and vegetables grown in-state. Michigan also has a long, rich history of farming, ranching, and cattle raising. Especially recently, with market response to recession, there has been an escalating push to support Michigan's local economy to keep money in the state. The purpose of generating this particular sample is to compare the ranked preferences of sustainable farming practices across Michigan consumers against all other states to distinguish differences in perceptions about sustainable agriculture.

The survey instrument was designed to address the research objectives such that respondents could easily identify their preferences. Marketing surveys that aim to measure the level of importance of given attributes often employ a Likert Scale rating system approach. However, this method has several weaknesses. First, scaled rating systems do not force the respondents to make trade-offs between attributes, as it is common for people to rate all attributes as very important. An additional criticism of this method has been confusion over a natural interpretation of the results, since a number scale has meaning only inside the survey context. To help address these issues, this survey uses a best-worst analysis (See Lusk and Briggeman 2009, Mueller and Rungie 2009, and Flynn and Louviere 2006) to investigate preferences for alternative sustainable farming practices.

Best-worst analysis requires the survey respondent to simultaneously choose the most and least preferred attributes out of a subset of competing options. This method is also often referred to as maximum difference scaling. The measured level of importance from best-worst analysis is applied to a standardized ratio scale that allows the reader to determine with more certainty the percentage difference in importance across attributes. Respondents of this survey were asked to answer a series of six questions to determine preferences for sustainable farming methods. The ten sustainable farming practices included were devised using information from the USDA and third party certifiers as follows, for produce (apples in our survey): ground cover management, fertilizer use, pesticide use, herbicide use, pollinator management, pest control, farm size, geographic level of production, consumer food prices, and financial stability of farmers. Similarly

the ten farming practices devised for beef (rib-eye steaks) were: use of antibiotics, use of growth hormones, use of genetically modified stock, animal health and safety, feed and waste management, pest control, farm size, geographic level of production, consumer food prices, and financial stability of farmers. The aforementioned attributes are all components of sustainable certification by Food Alliance, a private third-party agricultural certifier. These attributes span the three-pronged foundational framework suggested by Callens and Tyteca (1999) using economics, social and environmental metrics for evaluation.

The motivation for using a best-worst framework to assess consumer preferences has been largely inspired by the work of Mueller and Rungie (2009) on utility components that drive distinct consumer segments in the wine market, Umberger, Stringer and Mueller (2010) on market channel choice by small farmers in Indonesia, Flynn et al. (2007) on application of best-worst scaling for health care research, and Lusk and Briggeman(2009) on identifying consumer groups with similar food values. Additionally, Casini and Corsi (2009) and Cohen (2009) utilized best-worst scaling methodology in response to the tourist management industry in wine marketing. Also, Magidson and Vermunt (2001) advanced the strength of best-worst data using latent class factor and cluster models in sociological contexts. Also of note, the developments by Marley and Louviere (2005) of probabilistic models of best-worst choices provide the theoretical foundations for this analysis.

In designing the best-worst scenarios, the choice sets were created using a main effects full factorial design. The design was balanced with ten attributes, each exhibiting two levels. Twelve choice sets completed the fractional factorial design. For brevity, the twelve choice sets were broken down into two blocks of six and randomly assigned to participants. Each of these choice sets were chosen from the full factorial design such that the presence or absence of a particular farming practice was independent of the presence or absence of another. The choice made by the respondent should be conceptualized as choosing the two attributes that maximize the difference in utility gained between them on an underlying scale of preference. As noted, this model is useful because it can identify the relative preferences of consumers on a ratio scale. The stated preference methods outlined here are intended to approximate observed consumer behavior in real markets. The systematic variation of attribute choice sets is used to estimate the utility gained by the consumer across attribute levels.

Traditional discrete choice questions fail to address relative utility impacts across attributes. Best-worst scaling as originally devised by Flynn and Louviere in 1992 is capable of analyzing the efficiency of choice tasks as presented to a respondent. The specification of attributes from a choice set of competing scenarios, repeated over a number of variable choice sets allows observation of trade-off behavior. Best-worst tasks provide more information than single choice designs, while forcing respondents to consider the extremes of their utility space. The exclusion of "opt-out" infers that the decisions made by the consumer are conditional on the respondent participating in the market. The additional utility or dis-utility from moving between attribute levels can be estimated by a probit or logit model. This model captures the systematic propensity to choose one attribute over another across all choice sets and respondents.

The choice set for this analysis is developed around $K = 10$ attributes with L_k levels of attribute k . For our purposes, $L_k = 2 \forall k \in [1, K]$. The two levels indicate whether or not the good in question was produced in adherence to a particular sustainable farming practice. Scenarios are presented one at a time to the respondents, in which they indicate which attribute exhibits the highest and lowest utility impacts for them.

Best-worst scaling has foundations in Random Utility Theory as hypothesized by Thurstone (1927) and generalized by McFadden (1974). The formal statistical properties of this method were only recently proven by Marley and Louviere in 2005. The statistical assumptions underlying best-worst analysis theory propose that the proportional distance between two attribute levels on a latent utility scale represents the relative choice probability of a given pair of attributes. Cognitively, respondents are undertaking the task of identifying every pairing of attributes possible, calculating the difference in utility between every attribute pair, and choosing the pair that maximizes the utility difference between them. The distances between attributes are then modeled with the result that the pair-wise utilities are estimated in relation to a single attribute level rather than to an entire scenario.

The number of unique best-worst pairings to be chosen in each scenario as well as the reverse worst-best pairings is given by,

$$P(K) = 2[(K-1) + (K-2) + (K-3) + \dots + 2 + 1] \quad (1)$$

$$P(10) = 2[9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1] = 90 \quad (2)$$

In other words, algebraically there are

$$\sum_{j=1}^{K-1} j = (2(K-1)K)/2 = (K-1)K = 10(9) = 90 \quad (3)$$

pairs. The total number of possible scenarios to be presented to the respondent is given by,

$$levels^{attributes} = 2^{10} \quad (4)$$

where the two levels can be represented by a dummy variable

$$level = 1 \rightarrow included \quad (5)$$

$$level = 0 \rightarrow excluded \quad (6)$$

Data Collection

If, in every scenario, each attribute has the same number of levels, then the design is said to be balanced. The maximum number of possible scenarios, given this design, is the product of the number of levels across all attributes, in this case, 2^{10} , as derived above. For brevity, we chose to administer two versions of the orthogonal main effects plan indicated by "Block 1" or "Block 2". Respondents were randomly assigned to only one block of six best-worst scenarios. Participants were faced with the following example scenario in the apple survey.

Example

Which one of the following aspects of apple farming do you believe is the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important	Most Important
Ground Cover and Area Management Practices are Employed	
Little to No Chemical Pesticides are Used for Pest Management	
Pollinator Management is Employed	
Other Pests are controlled using preventative measures, and habitat controls	
Production, distribution, and sale is done locally	
Consumer food prices are affordable	

The orthogonal main effects pairing design ensured that each potential best-worst pair appeared exactly twice in each block of six scenarios. The main effects plan created a set of scenarios in which each attribute was seen by the respondent exactly four times. The four economic attributes were left to the interpretation of each respondent. Additionally, the respondents that indicated Michigan as their state of residence saw the economic attribute, "Michigan farmers are financially stable". The definitions of all non-economic attributes were provided prior to the best-worst block questions as follows:

In the next section you will be asked to choose which aspects of sustainable apple farming are most and least important to you. Please take the time to read the following definitions as related to sustainable production practices to better help you in your responses.

Ground Cover and Area Management Practices are Employed: Adjacent areas are planted with hedgerows, windbreaks, or other low-maintenance plantings to encourage specific beneficial organisms. Within tree rows, ground cover or mulch are selected and maintained to improve soil microbial activity, organic matter levels and nutrient cycling.

Fertilizer and Nutrient Materials are Used Minimally: Soil quality, including organic matter content, is established at planting and maintained at an optimum level to minimize commercial fertilizer needs.

Little to No Chemical Pesticides are Used for Pest Management: Chemical pesticides are not used. Alternative strategies are employed, including biopesticides, mating disruption, trap out and/or augmentation with beneficial organisms.

Little to No Chemical Herbicides are Used for Weed Management: Soil quality and ground cover in the orchard and adjoining areas are planned and managed to prevent weeds and weed seed immigration into the orchard. Cultural, mechanical or biological methods are used to control weeds.

Pollinator Management is Employed: Bees are not placed in the orchard until blossoms are open. Pesticides hazardous to bees are not used, or only if needed in an emergency.

Other Pests are Controlled Using Preventative Measures, and Habitat Controls: Habitat is modified around orchards to reduce nesting and perching sites for pest birds.

Additionally, for the beef survey:

In the next section you will be asked to choose which aspects of sustainable cattle farming are most and least important to you. Please take the time to read the following definitions as related to sustainable production practices to better help you in your responses.

Prohibited Use of Sub-therapeutic Antibiotics : Animals may only be treated with antibiotics when necessary for treatment of illnesses, provided they are not slaughtered within 45 days of last treatment.

Prohibited Use of Growth Hormones: The use of hormone treatments, including implants, to enhance growth is not permitted.

Prohibited Use of Genetically Modified Livestock: Animals produced through embryo transfer and those whose genetic material has been altered are not permitted.

Animal Health and Safety are Protected: Animal nutrition on the farm results in superior health as related to breeding success, weight gain, and freedom from illness. Policies are in effect for low-stress handling, preventative health measures, and regular maintenance and repair of facilities so as to prevent injury.

Feed is Pasture Based and Waste Management Systems Employed: Cattle receive majority of nutritional intake through grazing activity and animal movement is directed based on cattle's natural action and reaction to the situation. Manure resources are used to close the nutrient cycle on the farm, but only to the extent that overall nutrient levels are adequate and not excessive. Excess manure, if any, is put to good use off farm.

Pests are Controlled Using Preventative Measures, Cultural and Nutritional Controls: Preventative measures and/or cultural controls such as movement of cattle, sanitation, and composting are used to reduce or eliminate the need for insecticides and miticides. Animals are free to choose and move to habitats that are most comfortable such as shady areas, windy spots, or wallows.

Analysis

Analyzing choice data from a best-worst model is less straight forward than in other more traditional discrete choice methods. Common statistical packages like Stata currently do not have standardized commands for analyzing best-worst data. Therefore, this data was manipulated manually using Microsoft Excel and a program coded into SAS for further exposition. There are two primary ways of approaching best-worst data analysis. "Paired" models are used to make inferences about the latent utility scale, while "marginal" models aggregate over all pairs that include a given attribute level to model choice frequencies. This work concentrates on a marginal analysis approach. The intention is to further this analysis using paired models in the continuation of this work. The paired model methods are examined here for comparison to the marginal analysis. Both methods have the same measurement properties and can be analyzed at the respondent or sample level.

Paired Model Analysis

Paired analysis models the possible best-worst pairs that a respondent may choose. The number of observations is equal to the number of unique best-worst pairs (ninety). In a balanced design, such as the one used here, every attribute has the same number of levels (two) and each possible pair will be available to be chosen the same number of times (four). Each survey version (apple and beef) is analyzed separately, each with ninety observations representing the unique best-worst pairs, each of which appears twice in each block, for a total of four times in each survey. The impact weight for attribute k takes a value of one for all pairs in which attribute k was chosen as the most desirable and a value of minus one for all pairs in which attribute k was chosen as least desirable. These impact weights form the explanatory variables in the final regression used to estimate partial utility gain or loss. The equation to be estimated is given by

$$\ln(c_1) = \alpha + \beta_1 L_1 + \beta_2 L_2 + \beta_3 L_3 + \beta_4 L_4 + \dots + \beta_{10} L_{10} + \beta_{1,0} L_1^0 + \beta_{1,1} L_1^1 + \dots + \beta_{10,0} L_{10}^0 + \beta_{10,1} L_{10}^1 \quad (7)$$

where c_1 is the total number of times a particular best-worst pair was chosen across all scenarios and all respondents. L_k^0 indicates a scenario in which attribute k is excluded. Similarly, L_k^1 indicates a scenario in which attribute k is included. Sampling zeros were adjusted by adding the reciprocal of the sample size, as suggested by Flynn and Louviere, to enable logs to be taken. The natural log of c_1 , the total number of times a particular pair was chosen, is a linear function of the difference in utility acquired from each attribute. The parameter values estimated represent the average utility across the entire sample gained (or lost) by the particular sustainable farming production practice. The data can be used further to discover the extent of differences among subgroups of attribute impacts, where subgroups are defined by respondent-level demographic characteristics. This kind of limited dependent variable model requires the difference in probabilities of

pair-wise choice, for various scenarios in a choice set, to be associated with the differences in the explanatory variables. An important note about interpretation of the results needs to be made here. The main effect of a sociodemographic variable, such as age, on utility has no meaning in this context. However, the effect that age has on the utility gained for a specific attribute does have a meaningful interpretation. For our purposes each of the $2^{10} = 1024$ scenarios has $(K - 1)K = 90$ observations yielding a master data set of 92,160 possible pair-wise observations. The most flexible method of analysis for this format is to run a logit model using common statistical software on the expanded data set. For example, each sustainable farming practices scenario has 90 observations coded as the independent variables while the dependent variable is an indicator variable taking a value of one for the pair chosen and a value of zero if it is not chosen.

Marginal Model Analysis

The marginal method of analysis models the potential attribute levels that can be chosen. For the purposes of this work, each attribute is either strictly employed by the farmer for the agricultural good in question or is not. This method of analysis aggregates the data over best-worst pairs across all respondents to determine the utility gained by inclusion of a particular attribute. There are a total of $2 \sum_{k=1}^K L_k = 2(20) = 40$ observations. Each of the attribute levels contribute two observations, a best and a worst total. There are $K - 1 = 9$ impact variables and $L_k - 1 = 1$ effect coded scale level variables for each of the $K = 10$ attributes. The best-worst indicator variables take a value of one for all observations where the particular best-worst pair is chosen and negative one when the pair is chosen in the reverse order. The equation to be estimated is given by

$$\ln(c_2) = \alpha + bw_{indicator} + \beta_1 L_1 + \beta_2 L_2 + \beta_3 L_3 + \beta_4 L_4 + \dots + \beta_{10} L_{10} + \beta_{1,0} L_1^0 + \beta_{1,1} L_1^1 + \dots + \beta_{10,0} L_{10}^0 + \beta_{10,1} L_{10}^1 \quad (8)$$

where c_2 is the total number of times a particular attribute was chosen across all scenarios and all respondents, with a similar adjustment for observations of zero. Therefore, there are $\sum_{k=1}^K L_k = 20$ best totals and similarly $\sum_{k=1}^K L_k = 20$ worst totals. The regression results should be consistent with those of the paired method analysis. To analyze this marginal model in a multinomial framework, a logit model can again be estimated using common statistical software where each respondent contributes twenty observations; ten attributes that can be picked as best and ten attributes that can be picked as worst. If the most and least important farming production practices differ among consumers, we can classify consumers into unique segments of buyers allowing producers and certifying agencies to better understand the targeted consumer base for applications in marketing and policy.

Individual best-worst scores were determined for each attribute by the summation of the number of times each respondent indicated the attribute was most important less the summation of the number of times each respondent indicated the attribute was least important. The larger the B-W score, the more important the specific attribute is to

the individual. The individual attribute sums were aggregated across the sample to obtain the B-W measure for each attribute. Using a standardized interval scale, the relative importance of each attribute can be more easily interpreted. First the square root was taken of the aggregate frequency of best divided by the aggregate frequency of worst for each attribute. The highest $\sqrt{\frac{BEST}{WORST}}$ is scaled to 100 and all other attributes scaled relative to this attribute.

Latent Class Analysis

Latent class cluster analysis examines the heterogeneity of consumers in their ratings of farming production attributes and whether unique segments of consumers exist that can be explained by household and targeted marketing characteristics. This clustering technique assumes that individuals belong to one of L latent classes of a pre-determined size. The most common clustering methods involve minimizing within cluster variance and maximizing across cluster variance. Latent class clustering techniques estimate the probability of membership using the model parameters and observes impact measures of individual respondents. The covariation across individual observed preference scores measure utility to predict each respondent's unique membership within a particular latent class. Unobserved utility is heterogeneous across classes and homogeneous within a class. Using best-worst scaling we measure the individual importance of sustainable farming attributes to consumers.

The latent class cluster analysis uses the 1002 individual B-W scores as dependent variables to explore the heterogeneity across consumers in their perceptions of sustainable farming practices. The relative importance of each attribute to the sample is determined by evaluating the standardized interval scale as explained above. Additionally, an objective of this analysis is to determine which consumers are more or less likely to respond to certain marketing channel attributes.

In addition to the Latent Class clustering model, a principle component analysis derives distinct utility components that drive consumer behavior in each segment. The distinction of the principle components allows greater comparison of the segments across multiple utility dimensions. Principle component analysis is very useful in linking heterogeneity with the underlying drivers of consumer behavior.

Results

Variance-Covariance

The variance-covariance matrix from the individual B-W scores clarifies the attribute importance heterogeneity and correlations of attributes. Higher variance indicates a greater degree of heterogeneity across respondents. High covariance metrics indicate a strong relationship between attributes that may be preferred by the same consumer segment. This method of analysis is expanded on in Mueller and Rungie (2009) as applied to wine markets.

All Respondents

Table 3: Apple Production Attribute Variance-Covariance Matrix

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	0.83									
FN	-0.05	0.63								
CP	-0.25	0.04	1.28							
CH	-0.12	0.07	0.46	0.86						
PM	0.12	-0.01	-0.22	-0.12	0.75					
OP	0.09	-0.03	0.08	-0.02	0.02	0.59				
FS	-0.16	-0.26	-0.54	-0.32	-0.18	-0.27	2.58			
PL	-0.03	-0.13	-0.34	-0.25	-0.08	-0.16	-0.03	1.15		
CFP	-0.23	-0.13	-0.22	-0.22	-0.33	-0.11	-0.51	-0.09	1.76	
FF	-0.15	-0.09	-0.24	-0.28	-0.07	-0.15	-0.3	-0.06	0.14	1.19

The attribute in the apple survey with the highest variance is farm size followed by consumer food prices. It is interesting to note that farm size and consumer food prices also have a higher (negative) covariance than most of the other potential attribute pairs. This result indicates that consumers that place high importance on small farm size and limited corporate involvement are also likely to place significantly less importance on consumer food prices and vice versa. The covariance of these two attributes suggests that there exists a segment of consumers that display greater levels of sophistication in their understanding of value supply chains. These results support the hypothesis that a consumer segment exists in which there is a higher willingness to pay for sustainably produced foods that have origin on small farms with limited corporate involvement, perhaps due to advanced understanding of the additional costs of production that will be passed onto the consumer in the form of higher food prices. The other attribute pair exhibiting high covariance is farm size and prohibited use of chemical pesticides. The covariance between these attributes is significant and negative, indicating the potential for marketing sustainably labeled foods that come from larger corporate farm enterprises with attention paid to the reduced or eliminated chemical pesticide use on-farm.

Table 4: Beef Production Attribute Variance-Covariance Matrix

	SA	GH	GM	AS	PF	OP	FS	PL	CFP	FF
SA	0.71									
GH	0.18	1.31								
GM	-0.09	0.28	1.16							
AS	-0.07	-0.1	0.02	1.19						
PF	-0.01	-0.04	-0.08	0.04	0.54					
OP	-0.05	-0.14	-0.09	-0.06	0.04	0.9				
FS	-0.27	-0.65	-0.35	-0.37	-0.13	-0.22	2.33			
PL	-0.05	-0.26	-0.27	-0.24	-0.15	-0.07	0.05	1.12		
CFP	-0.15	-0.29	-0.36	-0.25	-0.14	-0.11	-0.31	-0.12	1.6	
FF	-0.19	-0.27	-0.22	-0.12	-0.14	-0.18	-0.08	-0.01	0.13	1.1

The attribute in the beef survey with the highest variance is again small farm size and limited corporate involvement. The attribute pair with the highest (negative) covariance is farm size and prohibited use of growth hormones. This

pairing is especially interesting because it indicates a strong (negative) link between an economic metric and a social metric for measuring sustainability. The use of growth hormones also has implications for human health and nutrition, especially for children in developmental stages. This result may support the hypothesis that the market can be distinctly segmented into consumers that make purchasing decisions driven by economic principles, and consumers that make purchasing decisions driven by more socially defined parameters.

Michigan Respondents

Table 5: Michigan Apple Production Attribute Variance-Covariance Matrix

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	0.87									
FN	-0.01	0.58								
CP	-0.28	0.04	1.26							
CH	-0.09	0.01	0.44	0.79						
PM	0.11	0	-0.24	-0.12	0.75					
OP	0.11	-0.05	0.06	-0.02	0.01	0.63				
FS	-0.14	-0.2	-0.52	-0.31	-0.14	-0.25	2.57			
PL	-0.04	-0.17	-0.32	-0.23	-0.07	-0.12	-0.13	1.19		
CFP	-0.3	-0.15	-0.22	-0.22	-0.37	-0.15	-0.49	0	1.77	
FF	-0.19	-0.03	-0.17	-0.23	-0.05	-0.19	-0.38	-0.1	0.16	1.17

Table 6: Michigan Beef Production Attribute Variance-Covariance Matrix

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	0.76									
FN	0.18	1.35								
CP	-0.13	0.31	1.25							
CH	-0.15	-0.05	0.04	1.29						
PM	0	-0.01	-0.1	0.03	0.51					
OP	-0.05	-0.13	-0.12	-0.07	0.02	0.95				
FS	-0.27	-0.66	-0.39	-0.39	-0.13	-0.16	2.42			
PL	-0.04	-0.26	-0.3	-0.27	-0.12	-0.1	0.03	1.09		
CFP	-0.1	-0.42	-0.41	-0.27	-0.13	-0.11	-0.33	-0.01	1.6	
FF	-0.18	-0.26	-0.15	-0.12	-0.13	-0.18	-0.1	-0.03	0.19	0.97

The Michigan sub-sample did not yield significantly different variance-covariance matrices. The positive and negative covariance measures retain the same (sign) relationships as in the larger national sample.

Attribute Importance

The attribute that is most important across the sample is the attribute with the highest B-W score. The mean individual B-W score is the average B-W score for each respondent and is determined by dividing the aggregate B-W score by the sample size. The relative importance of each attribute is then standardized to a ratio scale that has consistent interpretation outside of the survey context. The ratio scale is interpreted as the probability that a respondent prefers a particular sustainable farming practice attribute over the remaining nine alternatives. The ratio scale is calculated by transforming the square root of the best divided by worst scores to a scale of [0, 100]. All measures of attribute importance result in a ranking of the attributes in the same order.

The mean B-W score can be visualized with the aid of Figure 1. The bars represent the net average of the frequency each attribute was chosen as most or least important. For attributes chosen as most important with more frequency than

least important, the B-W score is greater than zero and is indicated by greater area to the right of center. Attributes in the middle were chosen as most important and least important a similar number of times.

Apple Survey: All Respondents

Table 7: Apple Production Attribute Importance Measures using Best-Worst Scaling

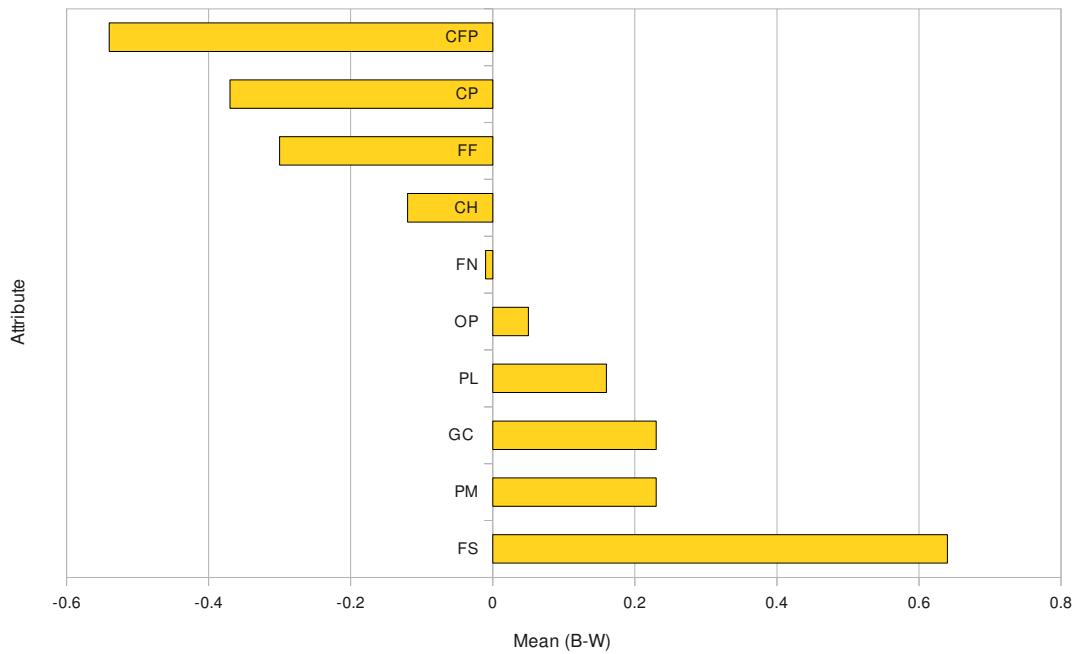
Attribute	Most	Least	Aggregate (B-W)	SQRT (B/W)	Standard Ratio	Mean (B-W)	STDEV B-W	Individual Ratio
Farm Size is small and Corporate Involvement is limited	759	120	639	2.51	100	0.64	1.61	100
Pollinator Management is Employed	388	136	252	1.69	67.16	0.23	0.87	35.94
Ground Cover and Area Management Practices are Employed	370	138	232	1.64	65.11	0.23	0.91	35.94
Production, distribution, and sale is done locally	392	229	163	1.31	52.02	0.16	1.07	25
Other Pests are controlled using preventative measures, and habitat controls	247	193	54	1.13	44.98	0.05	0.77	7.81
Fertilizer and Nutrient Materials are used minimally	196	205	-9	0.98	38.88	-0.01	0.79	-1.56
Little to No Chemical Herbicides are Used for Weed Management	223	341	-118	0.81	32.15	-0.12	0.93	-18.75
Farmers are financially stable	135	438	-303	0.56	22.07	-0.3	1.09	-46.88
Little to No Chemical Pesticides are Used for Pest Management	162	531	-369	0.55	21.96	-0.37	1.13	-57.81
Consumer food prices are affordable	140	681	-541	0.45	18.03	-0.54	1.32	-84.38

502 respondents were randomly assigned to complete the survey on apple production practices. Each respondent answered one block of six best-worst questions, yielding 3,012 observations of most important and 3,102 observations of least important. The data reveals that the attribute corresponding to "farm size is small and corporate involvement is limited" has the highest B-W score, as well as having the highest frequency of choice as most important. The next highest B-W score belongs to the attribute corresponding to "pollinator management is employed", suggesting that pollination is valued highly by this sample of consumers for its contribution as an ecosystem service to the farming industry. However, pollinator management has a mean B-W score with a little more than a third of the magnitude of the relative importance of the farm size attribute. "Production, distribution, and sale is done locally" also had a relatively high B-W score, ranking fourth among the attributes and about half as important as farm size. The attribute

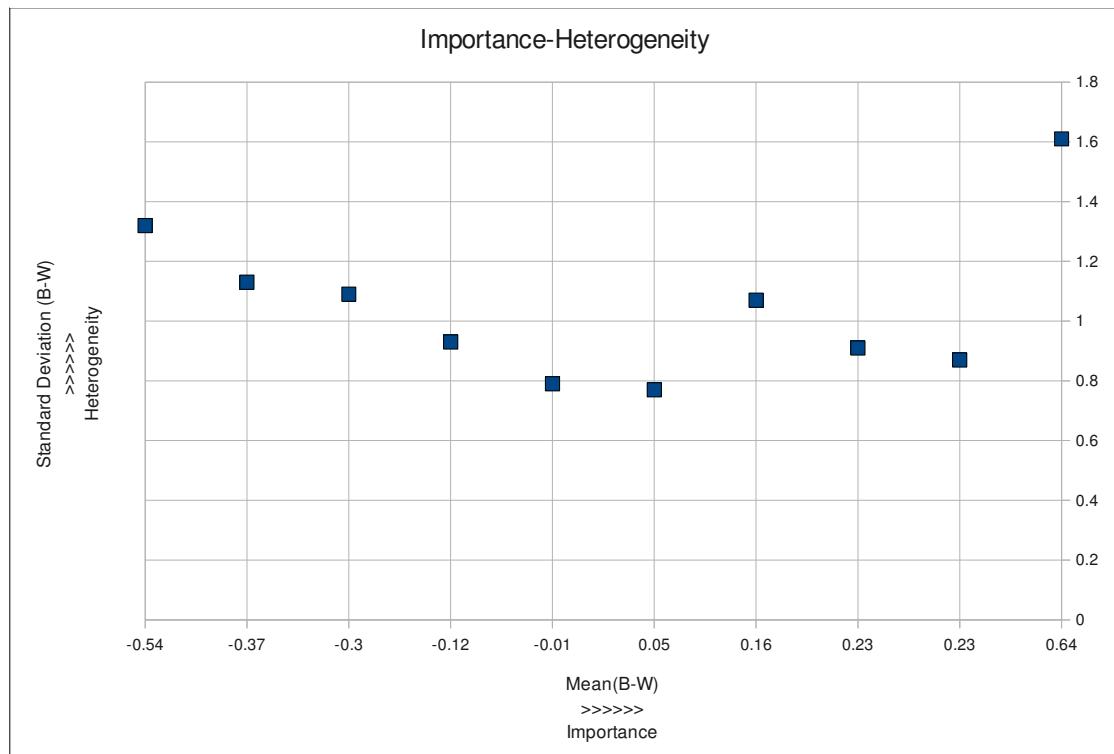
corresponding to "consumer food prices are affordable" has the lowest B-W score. This score indicates that this attribute was chosen as least important more often in each scenario than any of the other attributes.

When applied to a ratio scale, farm size is found to be more than five times as important to this sample of consumers than food prices. Also, for apple production the locality attribute ranks only half as important as farm size. The use of off-farm chemical inputs such as fertilizers, herbicides, and pesticides all ranked consistently between three and four times less important than farm size and only marginally more important than consumer food prices. Overall, two of the four economic attributes were ranked as highly important to this sample of consumers. Consumers from this sample perceive limited farm size and local production to contribute more credence to the sustainable label. The financial well-being of farmers and consumer food prices were not considered by this population to be highly important to the sustainability of the farming production system.

Apple B-W Summary



Importance-Heterogeneity



Graphs.pdf

Beef Survey: All Respondents

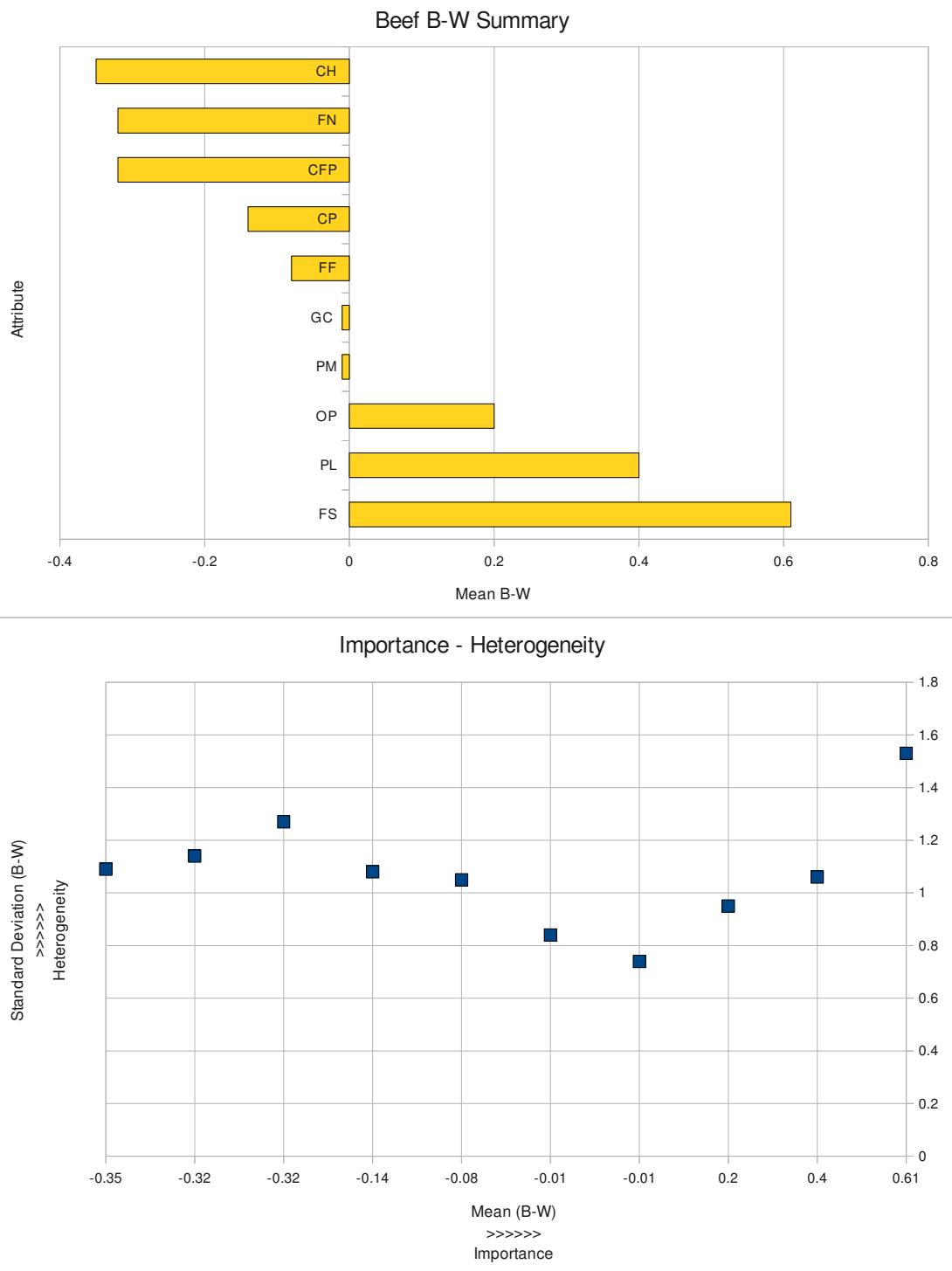
Table 8: Beef Production Attribute Importance Measures using Best-Worst Scaling

Attribute	Most	Least	Aggregate B-W	SQRT(B/W)	Standard Ratio	Mean Individual B-W	STDEV Individual B-W	Individual Ratio
Farm Size is small and Corporate Involvement is limited	729	117	612	2.5	100	0.61	1.53	100
Production, distribution, and sale is done locally	519	119	400	2.09	83.66	0.4	1.06	65.57
Pests are controlled using preventative measures, cultural and nutritional controls	351	153	198	1.51	60.68	0.2	0.95	32.79
Feed is Pasture Based and Waste Management Systems Employed	221	208	13	1.03	41.29	-0.01	0.74	-1.64
Prohibited use of sub-therapeutic antibiotics	216	227	-11	0.98	39.08	-0.01	0.84	-1.64
Farmers are financially stable	223	304	-81	0.86	34.31	-0.08	1.05	-13.11
Prohibited use of genetically modified livestock	238	374	-136	0.8	31.96	-0.14	1.08	-22.95
Consumer food prices are affordable	194	517	-323	0.61	24.54	-0.32	1.27	-52.46
Prohibited use of growth hormones	181	506	-325	0.6	23.96	-0.32	1.14	-52.46
Animal Health and Safety are Protected	128	475	-347	0.52	20.8	-0.35	1.09	-57.38

Similarly, 502 respondents were randomly assigned to complete the survey on beef production practices. Each respondent answered one block of six best-worst questions, yielding 3,012 "most important" observations and 3,102 "least important" observations. The data reveals again that the attribute corresponding to "farm size is small and corporate involvement is limited" has the highest B-W score, as well as having the highest frequency of choice as most important. The next highest B-W score belongs to the attribute corresponding to "Production, distribution, and sale is done locally", suggesting that, comparatively, locality of meat production is valued more highly than locality of apple production by this sample of consumers. The recent publicity of food traceability standards for meat may drive this result. Locality has a mean B-W score with roughly three quarters of the magnitude of the farm size attribute. The attribute corresponding to "animal healthy and safety is protected" has the lowest B-W score. This score indicates that this attribute was chosen as least important more often in each scenario than any of the other attributes. "Consumer food prices are affordable" also had a relatively low B-W score, along with "prohibited use of growth hormones".

When applied to a ratio scale, farm size is found to be more than five times as important to this sample of consumers

than animal health and safety. Similar to results from the apple survey, the respondents of the beef survey ranked financial well-being of farmers and consumer food prices in the bottom third on the importance ratio scale. The use of sub-therapeutic antibiotics and pasture based feed and waste systems have a near zero mean, indicating indifference among consumers in this sample. Overall, the same two of the four economic attributes were ranked as highly important to this sample of consumers, while the remaining two ranked relatively lower in importance. Consumers perceive the "sustainably produced" label to infer the importance of small scale, local beef production.



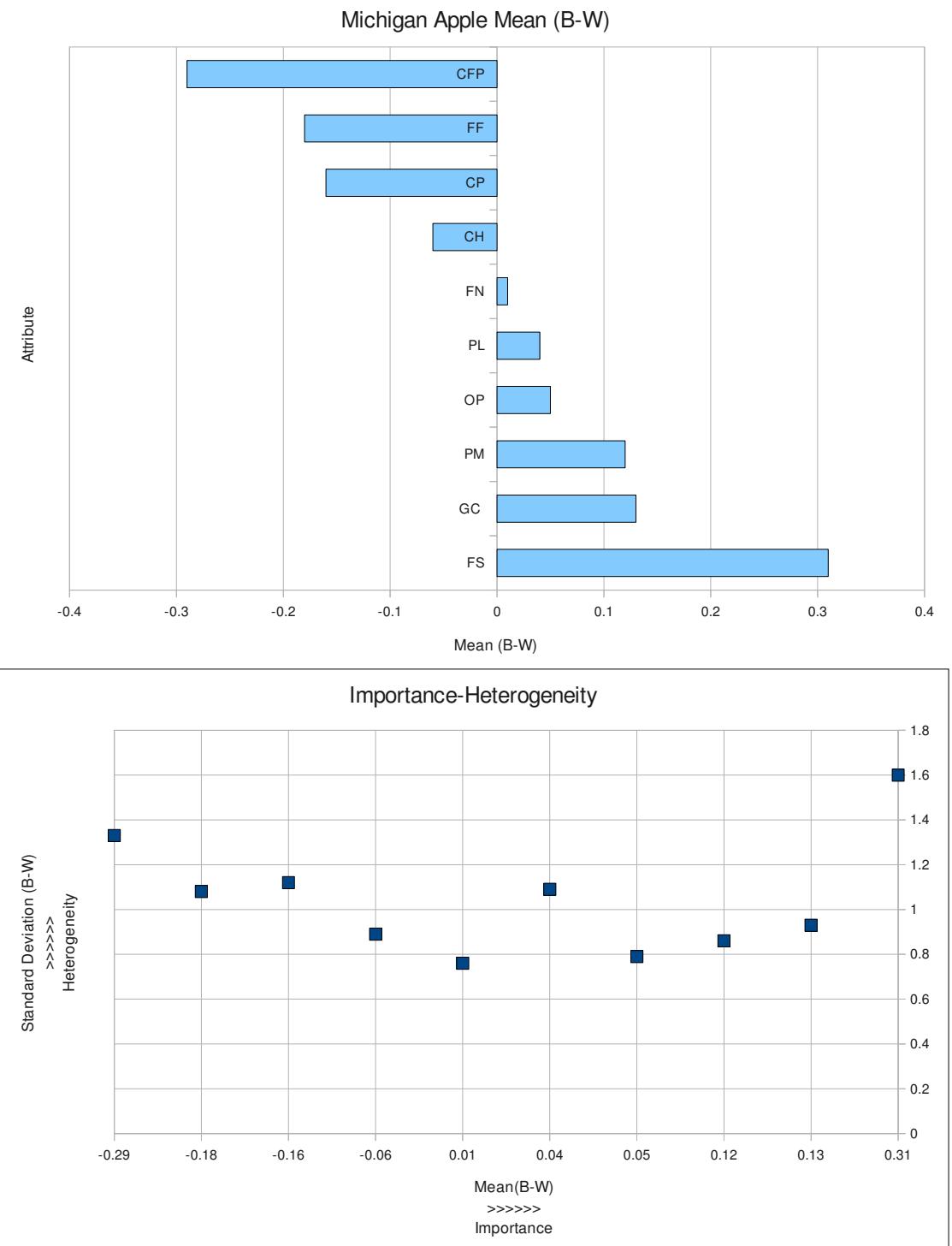
Graphs.pdf

Table 9: Michigan Apple Production Attribute Importance Measures using Best-Worst Scaling

Attribute	Most	Least	Aggregate (B-W)	SQRT (B/W)	Standard Ratio	Mean (B-W)	STDEV B-W
Farm Size is small and Corporate Involvement is limited	377	62	315	2.47	100	0.31	1.60
Ground Cover and Area Management Practices are Employed	196	64	132	1.75	70.97	0.13	0.93
Pollinator Management is Employed	205	80	125	1.6	64.92	0.12	0.86
Other Pests are controlled using preventative measures, and habitat controls	138	92	46	1.22	49.67	0.05	0.79
Production, distribution, and sale is done locally	174	129	45	1.16	47.1	0.04	1.09
Fertilizer and Nutrient Materials are used minimally	94	86	8	1.05	42.4	0.01	0.76
Little to No Chemical Herbicides are Used for Weed Management	107	165	-58	0.81	32.66	-0.06	0.89
Little to No Chemical Pesticides are Used for Pest Management	87	246	-159	0.59	24.12	-0.16	1.12
Farmers are financially stable	53	231	-178	0.48	19.42	-0.18	1.08
Consumer food prices are affordable	63	355	-292	0.42	17.08	-0.29	1.33

Apple Survey: Michigan Respondents

The Michigan apple survey respondents declared a differently ordered ranking of attributes. Additionally, the range of individual mean B-W scores is smaller for the Michigan sample, implying lower heterogeneity across consumers within the state. However, the relative attribute heterogeneity of each individual attribute remains similar to the national sample.

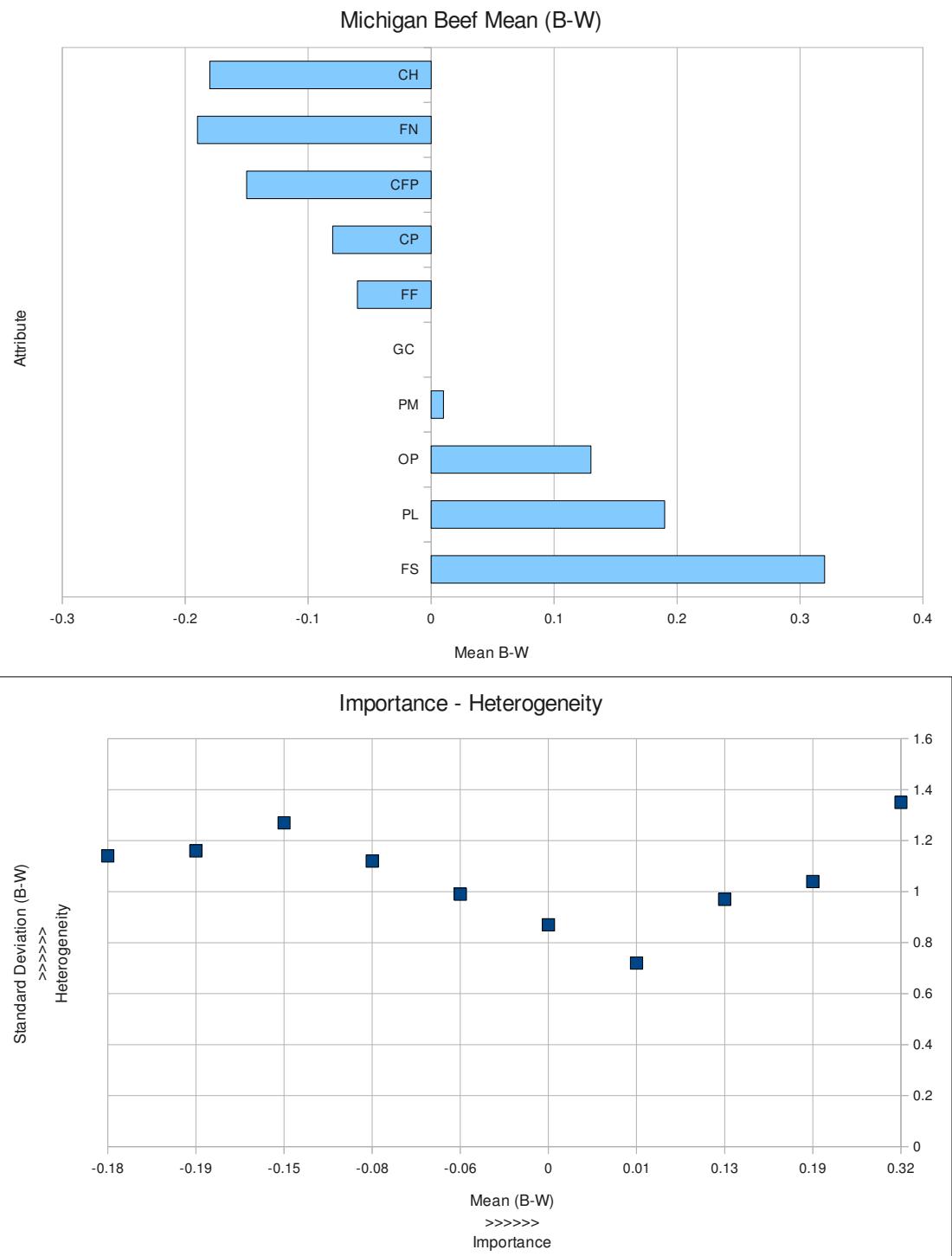


Beef Survey: Michigan Respondents

Table 10: Michigan Beef Production Attribute Importance Measures using Best-Worst Scaling

Attribute	Most	Least	Aggregate B-W	SQRT(B/W)	Standard Ratio	Mean Individual B-W	STDEV Individual B-W
Farm Size is small and Corporate Involvement is limited	377	54	323	2.64	100	0.32	1.35
Production, distribution, and sale is done locally	249	55	194	2.13	80.53	0.19	1.04
Pests are controlled using preventative measures, cultural and nutritional controls	194	68	126	1.69	63.93	0.13	0.97
Feed is Pasture Based and Waste Management Systems Employed	109	99	10	1.05	39.71	0.01	0.72
Prohibited use of sub-therapeutic antibiotics	108	113	-5	0.98	37	0	0.87
Farmers are financially stable	97	155	-58	0.79	29.94	-0.06	0.99
Prohibited use of genetically modified livestock	120	201	-81	0.77	29.24	-0.08	1.12
Consumer food prices are affordable	106	258	-152	0.64	24.26	-0.15	1.27
Prohibited use of growth hormones	83	270	-187	0.55	20.98	-0.19	1.16
Animal Health and Safety are Protected	63	242	-179	0.51	19.31	-0.18	1.14

The Michigan beef survey respondents declared the same ordered ranking as the national sample. The Michigan sample exhibits a smaller range for individual mean (B-W) values, implying lower heterogeneity among Michigan beef consumers. However the relative attribute heterogeneity pattern remains the same for both samples.



Attribute Heterogeneity

The mean B-W score for each attribute does not convey information about the similarity of importance placed on it by all consumers. A mean B-W score that ranks somewhere in the middle of all attributes may be caused by an averaging of respondents for whom the attribute is very important to some and very unimportant to others. This is a good illustration of the case of high consumer heterogeneity. The larger the range of consumer heterogeneity, the more the market will respond to targeting different consumers with variable channels of communication. The standard deviation of each individual B-W score across the sample measures the extent of variation amongst consumers over the relative importance of the attribute. A higher standard deviation indicates a wider variety of perceived importance for a given attribute. Conversely, a smaller standard deviation is indicative of general agreement across consumers on the relative importance of the sustainable farming production attribute. Therefore, the standard deviation is a good statistical measure of consumer heterogeneity across the sample for the attributes in question.

For our purposes, a standard deviation above 1 should be interpreted as high heterogeneity across consumers. A visual representation of importance heterogeneity is shown in Figure 2. The nodes found higher on the y-axis correspond to attributes with higher consumer heterogeneity. As demonstrated here, mean B-W scores do not tell the entire story. Attributes at both ends of the mean B-W spectrum exhibit varying degrees of importance heterogeneity. Ideally, marketing managers should exploit the attributes with high importance but additionally use specialized communication channels for attributes with high heterogeneity. Attributes with high B-W mean scores and high heterogeneity indicate greater importance to a select subgroup of consumers. Also, attribute with low B-W mean scores and high heterogeneity have potential in niche markets since it appeals primarily to a small segment of consumers.

Identification of distinct drivers of heterogeneity determines which attributes are related or jointly important for the same cluster of consumers. The variance-covariance matrix is useful here for outlining which attribute pairs vary simultaneously. If one attribute scores highly in B-W score, then an attribute that is highly covariant will also exhibit a high B-W score for the same group. Additionally, attributes that are highly negatively correlated will likewise drive the same segment of consumers but in opposite directions. For this reason, it is often easier to interpret the correlation coefficients because they are bounded in $[-1, 1]$. The basis for the clustering analysis comes from attributes that tend to be tracked together over consumers. A higher frequency of statistically significant correlation coefficients imply a more structured market.

Apple Survey

Table 11: Apple Production Attribute Correlation Coefficients

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	1									
FN	-0.06	1								
CP	-0.24	0.04	1							
CH	-0.15	0.1	0.45	1						
PM	0.15	-0.01	-0.22	-0.15	1					
OP	0.12	-0.05	0.1	-0.03	0.03	1				
FS	-0.11	-0.2	-0.31	-0.22	-0.12	-0.22	1			
PL	-0.04	-0.15	-0.28	-0.24	-0.09	-0.2	-0.01	1		
CFP	-0.2	-0.13	-0.15	-0.18	-0.28	-0.11	-0.24	-0.06	1	
FF	-0.15	-0.12	-0.19	-0.28	-0.07	-0.18	-0.17	-0.05	0.1	1

Table 12: Michigan Apple Production Attribute Correlation Coefficients

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	1									
FN	0	1								
CP	-0.25	0.05	1							
CH	-0.1	0.03	0.46	1						
PM	0.13	0	-0.23	-0.16	1					
OP	0.14	-0.08	0.08	-0.02	0.01	1				
FS	-0.08	-0.16	-0.31	-0.22	-0.09	-0.2	1			
PL	-0.06	-0.2	-0.26	-0.22	-0.08	-0.14	-0.07	1		
CFP	-0.25	-0.16	-0.16	-0.17	-0.32	-0.14	-0.23	0	1	
FF	-0.18	-0.06	-0.13	-0.25	-0.06	-0.22	-0.22	-0.08	0.11	1

The sustainable apple farming production attributes that exhibit the highest heterogeneity are farm size, consumer food prices, local distribution and production, pesticide use, and financial well-being of farmers, respectively. While consumer food prices are ranked as least important by mean B-W score, the high variance indicates that a small segment of consumers consider it very unimportant, while other segments disagree. Low mean and high variance pertain to products that have large potential in niche markets. In this case, it is likely that a small segment of consumers do not care at all (or nearly at all) about the price of the food labeled "sustainably produced", while other consumer respondents indicated relative importance of food prices. The high mean and high variance on the farm size attribute indicates that this attribute is very important to a smaller subset of consumers. The sample population contained a segment of consumers who placed a high value on small scale farming, while the other respondents gave mixed attribute importance measures. The authors hypothesize that both of these results point to the same or very similar small subset of consumers. It is possible that the consumers that highly value small production and limited corporate involvement understand that the minimized scale of production will likely cause prices to rise. For this particular subgroup higher consumer food prices are a reasonable trade off for sustainably produced food products from smaller farms. It is suggested here that this hypothesis be tested through factor analysis in the next step of this research.

Beef Survey

Table 13: Beef Production Attribute Correlation Coefficients

	SA	GH	GM	AS	PF	OP	FS	PL	CFP	FF
SA	1									
GH	0.19	1								
GM	-0.09	0.22	1							
AS	-0.09	-0.09	0.02	1						
PF	-0.02	-0.05	-0.1	0.06	1					
OP	-0.05	-0.13	-0.09	-0.05	0.06	1				
FS	-0.21	-0.37	-0.21	-0.22	-0.12	-0.15	1			
PL	-0.05	-0.21	-0.24	-0.2	-0.19	-0.07	0.03	1		
CFP	-0.14	-0.19	-0.26	-0.18	-0.15	-0.09	-0.16	-0.1	1	
FF	-0.21	-0.21	-0.19	-0.09	-0.18	-0.18	-0.05	-0.02	0.09	1

Table 14: Michigan Beef Production Attribute Correlation Coefficients

	GC	FN	CP	CH	PM	OP	FS	PL	CFP	FF
GC	1									
FN	0.17	1								
CP	-0.13	0.23	1							
CH	-0.17	-0.06	0.04	1						
PM	-0.01	-0.02	-0.13	0.04	1					
OP	-0.05	-0.12	-0.11	-0.06	0.03	1				
FS	-0.2	-0.36	-0.22	-0.22	-0.12	-0.11	1			
PL	-0.03	-0.21	-0.26	-0.21	-0.16	-0.1	0.02	1		
CFP	-0.09	-0.27	-0.28	-0.19	-0.14	-0.09	-0.17	-0.02	1	
FF	-0.19	-0.2	-0.13	-0.09	-0.19	-0.19	-0.07	-0.05	0.14	1

The sustainable beef production attributes that exhibit the highest heterogeneity are farm size, consumer food prices, use of growth hormones, animal health and safety, and use of genetically modified livestock, respectively. Similar to the apple survey data results, consumer food prices are ranked with low importance by mean B-W score. The high variance indicates that a small segment of consumers consider it very unimportant, while other segments disagree. Again, low mean and high variance pertain to meat products that have large potential in a niche market. These results bring similar conclusions as stated above for apples. Additionally, three very contentious ethical agricultural attributes exhibited high heterogeneity. The use of growth hormones, genetically modified livestock, and animal health and safety are issues that have been given a large amount of public attention by animal rights activist groups, organic farming advocates, and health officials alike. These three attributes hinge on several dimensions of consumer utility including food safety and human nutrition and health, while also considering intrinsic food values deeply connected to eco-responsibility movements and the emergence of socially alternative food markets. Umberger, McFadden, and Smith (2009) and Loureiro and Hine examine consumer valuation for hormone free and GM (genetically modified) free claims, respectively, and find that social dimensions of food values create distinct segments in the consumer market, as supported here.

Discussion

Labeling schemes have an ambiguous relationship with science. Each actor in the food supply chain holds different values and political ideologies that influence their experiences. Tools used in the green consumerism movement, such as food labels, are constantly reinvented and negotiated based on influences from both science and politics. As researchers, we strive to assess the effectiveness of these "green" or ethical claims at achieving sustainability goals. Bostrom and Klintman (2008) note several social trends that have contributed to the advent of food labeling: individualization, globalization, ecological modernization, a shift in orientation from production to consumption, a shift from government to governance, and the rise of private authorization in rule-making. As the food system has become globalized, labeling has become the regulatory response to the interaction and organization of the system. In addition, this particular consumerism movement focuses on improving corporate accountability through constant development of standards through market investigation and intervention.

Economically, labeling should be seen as a policy instrument that directs consumers by providing information. Labeling falls into a larger category of standards called, "eco-standards", not driven or backed solely by law. Food labeling, as discussed in this paper, is market-based and consumer oriented, relying on product differentiation through symbolism that continuously adjusts to market opportunities. The USDA may be most well known for developing sets of certifications, criteria, standards and recommendations to improve effective communication through marketed labeling schemes.

The educated food consumer assumes a role as a risk manager. Policy context factors such as political culture, existing rules and regulations, organizational foundation, and technology all provide opportunities and limitations for action. To improve the effectiveness of labeling schemes it is useful for initiators to consider framing strategies that define and establish a label, as put forward in Bostrom and Klintman's book, "Eco-standards, Product Labeling and Green Consumerism". First a boundary must be clearly defined between what is labeled "sustainable" and what is labeled "conventional". Next a resolution of criteria and standards must develop a common understanding about the purposes about a specific label. Finally, there must be reflection on the possible paths toward improving understanding for consumers and stakeholders alike.

This paper addresses the three above mentioned framing strategies. Through the continuation of this research, the authors aim to identify the level of common understanding and purposes of the "sustainably produced" label and reflect on potential marketing avenues certifying agencies may follow in the future. Howard (2006) shows that there exists an overwhelming consumer preference for product information in the form of labels and other communicative methods at the point of purchase. Certifying agencies have the opportunity to expand the information available to the consumer that interacts with the product, eventually making recognition of the label socially normative in future transactions.

A study conducted by Abrams, Meyers, and Irani (2010) on the perception of all natural and organic pork products found that consumer perceptions of "organic" labels are often being confused with other eco-labeling schemes, such as

“natural” and “sustainably produced”. The concept of creating a new labeling system that goes beyond organic may allow small scale farmers and producers growth benefits in addition to providing a higher level of ethical information than that of the “USDA Organic” label (Howard and Allen 2006). However it has been recommended by developers to avoid consumer confusion by clearly distinguishing between eco-labeling schemes, while allowing them to coexist. Sustainable labels intend to address consumer perceptions and preferences in order to influence purchasing decisions. The future direction of this work aims to continue assessing how consumer perceptions about sustainable farming practices may influence price premiums paid for eco-labeled foods.

Conclusions

Best-worst analysis was applied in this research to investigate the degree of importance consumers give to ten sustainable farming production attributes and in particular was used to determine behavioral differences across the population sample. The advantages of this methodology compared to more traditional stated preference analysis is evident in its higher discriminatory power for measuring trade-off decision making and in its wider applicability and interpretation outside of the survey context. While avoiding common rating bias, best-worst analysis results can be used in cross national and cross regional comparison studies on diverse populations and their judgment of similar attributes. This study gives credence to the strength of the best-worst method in yielding clear and simple interpretations. The simplicity of this analysis can be applied by marketing managers to gain insight into the evaluation behavior of different consumer sub-groups for targeted labeling.

As with any research project, there are several limitations to this study. First, the lack of qualitative data may be less than ideal for some social scientists. Had focus groups been conducted with consumers first, the survey may have been developed differently to better distinguish perceptions and explore hypothetical market behavior. Secondly, choosing only ten sustainable farming attributes for the best-worst analysis is in itself constrictive and limiting. Each of the attributes could have been broken into several alternative attributes. However, with each additional attribute, the size of the full factorial design grows quickly. In the future it may be useful to run consumer focus groups to assess which attributes are most useful for inclusion in a study similar to this. Finally, it should be noted that screening for vegetarianism may have been helpful in the data collection. Several vegetarians were randomly assigned to the beef survey, which makes their willingness to pay estimates questionable. This final issue is of more concern for the next stage of this project evaluating choice experiment data and may be irrelevant for the best-worst perception data analysis.

The information gathered here from consumer data collected on perceptions about sustainable farming production practices holds large potential for marketing managers. The unique best-worst methodology provides additional insight into determinants of market behavior. In both beef and apple surveys, consumers indicated a strong perceptive correlation between sustainably produced labels and the size and locality of the farm of origin. The current available product

differentiation schemes involve information and certifications related to variable production practices. This analysis suggests, similar to the findings of Onozaka and McFadden (2010), that consumers perceive quality differences for locally grown and distributed products. Supporting studies, such as that of Bond, Thimany and Keeling-Bond (2008) give evidence that preferences for local food are significantly related to factors affecting farmer viability, sustaining local farm land, and contributing to smaller, local economies. Our work supports these findings that scale and geographic range factor heavily into consumer perceptions of "sustainably" labeled food products.

Sustainability claims on food targets many dimensions of consumer utility from quality and safety concerns to more intrinsic valuation connected to underlying food values such as fairness and the environment. In effect, some sustainability claims may be perceived by consumers as substitutable, while others are complementary, a point emphasized by the work of Onozaka and McFadden (2010). The value of a sustainable certification may only contribute marginally to the locality of a food product, while in other situations it may enhance the commitment to more well-rounded sustainable farming practices. It is important to consider how consumer willingness to pay varies for multiple combinations of sustainable farming production attributes. This body of work suggests that differentiating food claims on the level of locality and corporate involvement may be a successful avenue of marketing. The future of this research will concentrate on using willingness to pay measurements of sustainable labeling schemes to compare with other niche markets such as local and organic.

Appendix

Sustainably Produced Apples: A Survey of Your Opinions

This is a survey designed to obtain information from Michigan consumers regarding food consumption habits and related issues. Your participation in this survey is entirely voluntary and your responses will be kept in strict confidence. The data gathered from this survey is needed for analysis in the dissertation work of an MSU graduate student. If you have any questions, comments, or concerns regarding this survey, please contact Dr. Robert Shupp by email (shupprob@anr.msu.edu) or by phone (517-432-2754).

1. I am:

Male

Female

2. I am ____ years old. (Please fill in the blank.)

3. I live in the _____ zip code area (Please fill in the blank.) and my annual pre-tax, household income is:

Less than \$20,000

\$20,000 - \$39,999

\$40,000 - \$59,999

\$60,000 - \$79,999

\$80,000 - \$99,999

\$100,000 - \$119,999

\$120,000 - \$139,999

\$140,000 - \$159,999

\$160,000 or more

4. The best description of my educational background is:

Did not graduate from high school

Graduated from high school, Did not attend college

Attended College, No Degree earned

Attended College, Associates or Trade Degree earned

Attended College, Bachelors (B.S. or B.A.) Degree earned

Graduate or Advanced Degree (M.S., Ph.D., M.D., Law School)

Other (Please explain.) -----

5. There are ___ adults and ___ children living in my household. (Please fill in the two blanks.)

6. What best describes your race?

White or Caucasian

- Black or African-American
- Asian or Pacific Islander
- Mexican or Latino
- American Indian
- Other (Please describe.) -----

7. Are you the primary food/grocery shopper in your household? (e.g. the individual most often purchasing food) ?

- Yes
- No

8. Do you currently receive food assistance?

- Yes
- No

9. If you receive food assistance, please check off all forms of food assistance you receive:

- Food Stamps
- WIC
- Project Fresh
- Food Bank
- Soup Kitchen
- Other (Please specify.) -----

10. Most households consume on average 21 meals in a typical week. How many of these 21 meals consumed by your household normally include:

- a. Apples: -----
- b. Other fruits, besides apples: -----

11. Consumers purchase food from many sources. Please allocate the proportion of your households total food purchases across each of the following (Sum to 100%):

- a. Supermarket Retailers (e.g. Kroger, Meijer, Wal-Mart) ----- %
- b. Targeted Retailers (e.g. Whole Foods, Foods for Living, Better Health) ----- %

c. Food Cooperative (e.g. ELFCO)_____ %

d. Convenience Stores (e.g. Quality Dairy, 7-Eleven)_____ %

e. Farmers Markets/ CSAs_____ %

f. Butcher_____ %

g. Other (Please describe.) _____

12. Please rate the following statement in terms of your **agreement**:

“I rarely think about the sustainability of production practices when making food purchases”.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

13. Please rate the following statements in terms of your **agreement** (Please circle only one in each row.): "I believe that"

	Strongly Disagree						Strongly Agree
farmers face lower levels of productivity when using sustainable food production practices.	1	2	3	4	5	6	7
farmers could sustainably produce food without much additional monetary expense.	1	2	3	4	5	6	7
farmers currently participate in sound sustainable food production practices.	1	2	3	4	5	6	7
organic products are from farms currently participating in sound sustainable food production practices.	1	2	3	4	5	6	7
locally grown products are from farms currently participating in sound sustainable food production practices.	1	2	3	4	5	6	7
smaller farms are more likely to currently participate in sound sustainable food production practices.	1	2	3	4	5	6	7
corporate farms are more likely to currently participate in sound sustainable food production practices.	1	2	3	4	5	6	7
all products labeled sustainably produced are from farms currently participating in sound sustainable food production practices.	1	2	3	4	5	6	7

14. Please rank the following societal issues in order of importance to you (1 being most important and 8 being the least important):

- Human Poverty-----
- U.S. Health Care System-----
- Food Safety-----
- Sustainable Agriculture-----
- The Environment-----
- Financial Well-Being of U.S. Farmers-----
- Consumer Food Prices-----
- Animal Well-Being and Welfare-----

In the next section you will be asked to choose which aspects of sustainable apple farming are most and least important to you. Please take the time to read the following definitions as related to sustainable production practices to better help you in your responses.

Ground Cover and Area Management Practices are Employed: Adjacent areas are planted with hedgerows, windbreaks, or other low-maintenance plantings to encourage specific beneficial organisms. Within tree rows, ground cover or mulch are selected and maintained to improve soil microbial activity, organic matter levels and nutrient cycling.

Fertilizer and Nutrient Materials are used minimally: Soil quality, including organic matter content, is established at planting and maintained at an optimum level to minimize commercial fertilizer needs.

Little to No Chemical Pesticides are Used for Pest Management: Chemical pesticides are not used. Alternative strategies are employed, including biopesticides, mating disruption, trap out and/or augmentation with beneficial organisms.

Little to No Chemical Herbicides are Used for Weed Management: Soil quality and ground cover in the orchard and adjoining areas are planned and managed to prevent weeds and weed seed immigration into the orchard. Cultural, mechanical or biological methods are used to control weeds.

Pollinator Management is Employed: Bees are not placed in the orchard until blossoms are open. Pesticides hazardous to bees are not used, or if needed in an emergency, are applied such that they are not hazardous to bees.

Other Pests are controlled using preventative measures, and habitat controls: Habitat is modified around orchards to reduce nesting and perching sites for pest birds.

15. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Ground Cover and Area Management Practices are Employed	
	Little to No Chemical Pesticides are Used for Pest Management	
	Other Pests are controlled using preventative measures, and habitat controls	
	Farm Size is smaller than average and Corporate Involvement is limited	
	Michigan farmers are financially stable	

16. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Ground Cover and Area Management Practices are Employed	
	Little to No Chemical Herbicides are Used for Weed Management	
	Pollinator Management is Employed	
	Farm Size is small and Corporate Involvement is limited	
	Production, distribution, and sale is done locally	
	Michigan farmers are financially stable	

17. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Ground Cover and Area Management Practices are Employed	
	Fertilizer and Nutrient Materials are used minimally	
	Little to No Chemical Pesticides are Used for Pest Management	
	Little to No Chemical Herbicides are Used for Weed Management	
	Pollinator Management is Employed	
	Other Pests are controlled using preventative measures, and habitat controls	
	Farm Size is small and Corporate Involvement is limited	
	Production, distribution, and sale is done locally	
	Consumer food prices are affordable	
	Michigan farmers are financially stable	

18. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Fertilizer and Nutrient Materials are used minimally	
	Little to No Chemical Pesticides are Used for Pest Management	
	Little to No Chemical Herbicides are Used for Weed Management	
	Other Pests are controlled using preventative measures, and habitat controls	
	Farm Size is small and Corporate Involvement is limited	
	Production, distribution, and sale is done locally	

19. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Fertilizer and Nutrient Materials are used minimally	
	Pollinator Management is Employed	
	Other Pests are controlled using preventative measures, and habitat controls	
	Farm Size is small and Corporate Involvement is limited	
	Consumer food prices are affordable	
	Michigan farmers are financially stable	

20. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Ground Cover and Area Management Practices are Employed	
	Fertilizer and Nutrient Materials are used minimally	
	Farm Size is small and Corporate Involvement is limited	
	Production, distribution, and sale is done locally	
	Consumer food prices are affordable	

15. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important	Most Important
Ground Cover and Area Management Practices are Employed	
Fertilizer and Nutrient Materials are used minimally	
Little to No Chemical Herbicides are Used for Weed Management	
Pollinator Management is Employed	
Other Pests are controlled using preventative measures, and habitat controls	

16. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important	Most Important
Little to No Chemical Herbicides are Used for Weed Management	
Other Pests are controlled using preventative measures, and habitat controls	
Production, distribution, and sale is done locally	
Consumer food prices are affordable	
Michigan farmers are financially stable	

17. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important	Most Important
Ground Cover and Area Management Practices are Employed	
Little to No Chemical Pesticides are Used for Pest Management	
Pollinator Management is Employed	
Other Pests are controlled using preventative measures, and habitat controls	
Production, distribution, and sale is done locally	
Consumer food prices are affordable	

18. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Fertilizer and Nutrient Materials are used minimally	
	Little to No Chemical Pesticides are Used for Pest Management	
	Pollinator Management is Employed	
	Production, distribution, and sale are done locally	
	Michigan farmers are financially stable	

19. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Ground Cover and Area Management Practices are Employed	
	Fertilizer and Nutrient Materials are used minimally	
	Little to No Chemical Pesticides are Used for Pest Management	
	Little to No Chemical Herbicides are Used for Weed Management	
	Consumer food prices are affordable	
	Michigan farmers are financially stable	

20. Which one of the following aspects of apple farming do you believe are the most and least important in a sustainable apple production system? Please check only one in each column.

Least Important		Most Important
	Little to No Chemical Pesticides are Used for Pest Management	
	Little to No Chemical Herbicides are Used for Weed Management	
	Pollinator Management is Employed	
	Farm Size is small and Corporate Involvement is limited	
	Consumer food prices are affordable	

21. To the best of your knowledge, for each of the apple production practices indicated, production involves which of the following restrictions? Check all that apply.

	Sustainable	Organic	Local	Typical
Require ground cover and area management				
Limited use of fertilizer and nutrient materials				
Prohibited use of herbicides for crops				
Prohibited use of insecticides for crops				
Prohibited use of genetically modified organisms				
Limited corporate involvement				
Limited farm acreage				

22. Which one of the following best describes the proximity from your home you consider locally grown apples to originate from?

- a. within 10 miles
- b. within 50 miles
- c. within 100 miles
- d. within 500 miles
- e. within Michigan
- f. Other (Please describe.) -----

23. Would you be willing to pay a premium for apples labeled as sustainably produced?

- Yes
- No

24a. If Yes, Would you buy apples labeled as sustainably produced if it cost $\$1.49 + 1.49*X\%$?

- Yes
- No

24b. If No, Would you buy apples labeled as sustainably produced if it cost $\$1.49 - 1.49*X\%$?

- Yes
- No

25. Please rank the emphasis you believe **farmers** producing sustainably produced apples place on the following issues/concerns.

(1 being most emphasis and 6 being the least emphasis):

- a. Profitability of their farm
- b. Food prices faced by consumers
- c. Quantity of their farms production
- d. Impact their farm has on the environment
- e. Food safety of products produced on their farm
- f. Quality of apples produced

Please consider the following information [provided by Food Alliance, an independent third party certifier of sustainably produced foods]:

The impacts of food production have become a mainstream concern. Expectations for traceability, transparency and accountability in agriculture and the food industry are increasing. Sustainable agriculture comprises the ability to produce safe, healthy, delicious, and affordable food to meet needs without degrading agricultural lands, the quality of life in our communities, or the resiliency of the broader ecosystems on which we all depend. Farms employing sustainability practices place important on issues including safe and fair working conditions, humane treatment of animals, and protection of the environment. Sustainable farms should be held to the following standards:

1. Protect, enhance, and conserve soil resources, water resources, and biodiversity

Food production improves soil productivity, protects water quality and supply, and supports healthy native plant and animal communities.

2. Conserve energy, reduce and recycle waste

Waste streams from food production are minimized while reuse, recycling, and composting of resources is maximized. Businesses invest in innovation and improvement to ensure efficient use and management of natural resources for energy and packaging, transport, and daily operations.

3. Reduce use of pesticides, and other toxic and hazardous materials

Food businesses avoid use of chemicals that have adverse impacts on the health of ecosystems. Agriculture relies on a biologically based system of Integrated Pest Management. Materials used for sanitation, pest control, waste treatment, and infrastructural maintenance are chosen to reduce overall negative consequences.

4. Maintain transparent and sustainable chain of custody

Farmers and food industry workers have secure and rewarding jobs that provide a sound livelihood. Throughout the entire supply chain, food is produced and handled in accordance with these Principle Values. Transparency is maintained independent standards, third-party audits and clear labeling.

5. Guarantee product integrity, no genetically engineered or artificial ingredients

Foods are not produced using synthetic preservatives, artificial colors and flavors, genetically modified organisms (GMOs), or products derived from livestock treated with sub-therapeutic antibiotics or growth-promoting hormones.

6. Support safe and fair working conditions

Employers respect workers rights and well-being, make safety a priority, maintain a professional workplace, and provide opportunities for training and advancement.

7. Ensure healthy, humane animal treatment

Animals are treated with care and respect. Living conditions provide access to natural light, fresh air, fresh water, and a healthy diet, shelter from extremes of temperature, and adequate space and the opportunity to engage in natural behaviors and have social contact with other animals. Livestock producers minimize animal fear and stress during handling, transportation and slaughter.

8. Continually improve practices

Food businesses are committed to continually improving management practices. Improvement goals are integrated into company culture, regularly monitored, and acknowledged when achieved. Food buyers are proactively engaged in the food system, and support companies that are transparent about their improvement goals and progress.

In the next section you will be presented with multiple different alternative apples that could be available for purchase in a retail store where you typically shop. Besides the attributes listed below, each product possesses the same characteristics (e.g., similar color and freshness) and is produced in the U.S. Prices vary for each product and are all in \$/lb. units. Please consider the following information to help you interpret alternative products.

Label: The display that contains the apples for your purchase may be labeled as follows:

- Sustainable: These apples were produced using sustainable practices.
- Organic: These apples were produced using organic practices.
- Local: These apples were produced for distribution and sale locally.
- Typical: These apples are not labeled to suggest they were produced using any of the criteria listed above.

Certification: The typical product has no certification label. Each labeled product can be certified in one of three ways:

- USDA: The processes used and all claims made by the product label have been verified by the USDA.
- Independent Third Party: The processes used and all claims made by the product label have been verified by a third party unrelated to the farm of origin or retailer.
- Self: The processes used and all claims made by the product label have been verified by the farmer producing the food.

The experience from previous similar surveys is that people often state a higher willingness to pay than what one is actually willing to pay for the good. For instance, a recent study asked people whether they would purchase a new food product similar to the one you are about to be asked about. This purchase was hypothetical (as it will be for you) in that no one actually had to pay money when they indicated a willingness to purchase. In the study, 80% of people said they would buy the new product, but when a grocery store actually stocked the product, only 43% of people actually bought the new product when they had to pay for it. This difference (43% vs. 80%) is what we refer to as hypothetical bias.

Accordingly, it is important that you make each of your upcoming selections like you would if you were actually facing these exact choices at a store; noting that buying a product means that you would have less money available for other purchases.

26. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	Self	USDA		
Price	\$0.99 /lb	\$0.99 /lb	\$1.99 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

27. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	USDA	USDA		
Price	\$1.99 /lb	\$1.49 /lb	\$0.99 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

28. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	Self	Private 3rd Party		
Price	\$1.49 /lb	\$1.99 /lb	\$0.99 /lb	\$1.49 /lb	
	<input type="checkbox"/>				

29. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	Private 3rd Party	Self		
Price	\$1.49 /lb	\$1.49 /lb	\$1.99 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

30. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Self	Self	Self		
Price	\$0.99 /lb	\$1.49 /lb	\$0.99 /lb	\$1.49	
	<input type="checkbox"/>				

31. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	Self	Private 3rd Party		
Price	\$1.99 /lb	\$1.49 /lb	\$1.99 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

32. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	Private 3rd Party	Self		
Price	\$1.99 /lb	\$1.99 /lb	\$0.99 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

33. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	Self	Self		
Price	\$1.49 /lb	\$0.99 /lb	\$1.49 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

34. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	USDA	Private 3rd Party		
Price	\$0.99 /lb	\$0.99 /lb	\$0.99 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

26. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Self	Self	USDA		
Price	\$1.99 /lb	\$1.99 /lb	\$1.49 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

27. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	USDA	Self		
Price	\$0.99 /lb	\$1.99 /lb	\$1.49 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

28. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	Private 3rd Party	Private 3rd Party		
Price	\$1.99 /lb	\$0.99 /lb	\$1.49 /lb	\$1.49 /lb	
	<input type="checkbox"/>				

29. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	Private 3rd Party	USDA		
Price	\$0.99 /lb	\$1.49 /lb	\$1.49 /lb	\$1.49 /lb	
	<input type="checkbox"/>				

30. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	USDA	USDA	USDA		
Price	\$1.49 /lb	\$1.99 /lb	\$1.99 /lb	\$1.49 /lb	
	<input type="checkbox"/>				

31. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Self	Private 3rd Party	USDA		
Price	\$1.49 /lb	\$0.99 /lb	\$0.99 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

32. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Self	USDA	Self		
Price	\$1.99 /lb	\$0.99 /lb	\$1.99 /lb	\$1.49 /lb	
	<input type="checkbox"/>				

33. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options
Certification	Self	Private 3rd Party	Private 3rd Party		
Price	\$0.99 /lb	\$1.99 /lb	\$1.99 /lb	\$0.99 /lb	
	<input type="checkbox"/>				

34. Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Self	USDA	Private 3rd Party		
Price	\$1.49 /lb	\$1.49 /lb	\$1.49 /lb	\$1.99 /lb	
	<input type="checkbox"/>				

Thank you for your time in completing this survey. Your input will strengthen our research and help us obtain more accurate conclusions. If you wish to add any comments please feel free to do so here:

References

Abrams, Katie, Courtney Meyers, and Tracy Irani, 2010. Naturally Confused: Consumers' Perceptions of All-Natural and Organic Pork Products. *Agriculture and Human Values* 27: 365-374.

Auger, P., Devinney, T., Louviere, J., 2007. Using best-worst scaling methodology to investigate consumer ethical beliefs across countries. *Journal of Business Ethics* 70, 299-326.

Bond, C.A., D. Thilmany, and J. Kelling-Bond, 2008. Understanding consumer interest in product and process based attributes for fresh produce. *Agribusiness* 24, 231-252.

Bostrom, Magnus, and Mikael Klintman. 2008. Eco-standards, product labeling and green consumerism. Hounds-mills, Basingstoke, Hampshire: Palgrave Macmillan.

Clonan, A., Holdsworth, M., Swift, J., and Wilson, P., 2010. UK consumers priorities for sustainable food purchases. <http://purl.umn.edu/91948>

Cohen, E., 2009. Applying best-worst scaling to wine marketing. *International Journal of Wine Business Research* 21, 8-23.

Conner, D., V. Campbell-Arvai, and M. Hamm, 2008. Value in the values: pasture-raised livestock products offer opportunities for reconnecting producers and consumers. *Renewable Agriculture and Food Systems* 23(1): 62-69.

Howard, P.H. and P. Allen, 2006. Beyond organic: consumer interest in new labeling schemes in the central coast of California. *International Journal of Consumer Studies*, 30(5):439-451.

Howard, Philip H. 2006. Central Coast Consumers Want More Food-Related Information, From Safety to Ethics. *California Agriculture*, 60(1), 14-19

Flynn, T.N., Louviere, J.J., et al. 2007. Best-worst scaling: What it can do for health care research and how to do it. *Journal of Health Economics* 26, 171-189.

Jaeger, S.R., A.S.Jorgensen, M.D. Aaslyng, W.L.P. Bredie, 2008. Best-worst scaling: An introduction and initial comparison with monadic rating for preference elicitation with food products. *Food Quality and Preference* 19, 579-588.

Louviere, J.J., 2001. What if consumer experiments impact variances as well as means: response variability as a behavioral phenomenon. *Journal of Consumer Research* 28, 506-522.

Lusk, J.L., and B. Norwood, 2005. Effect of experimental design on choice-based conjoint valuation estimates. *American Journal of Agricultural Economics* 87, 771-785.

Lusk, J.L. and Briggeman, B., 2009. Food values. *American Journal of Agricultural Economics* 91, 1-13.

Magidson, J. and Vermunt, J.K., 2001. Latent class factor and cluster models, bi-plots, and related graphical displays. *Sociological Methodology* 31, 223-264.

Marley, A.A.J., Louviere, J.J., 2005. Some probabilistic models of best, worst, and best-worst choices. *Journal of Mathematical Psychology* 49, 464-480.

McIntosh, E., Louviere, J.J., 2002. Separating weight and scale value: an exploration of best-attribute scaling in health economics, *Health Economists' Study Group Meeting Notes*, Brunel University.

Mueller, S., Francis, L., and Lockshin, L., 2010. Comparison of best-worst and hedonic scaling for the measurement

of consumer wine preferences. *Australian Journal of Grape and Wine Research*.

Mueller, S., and Rungie, C., 2009. Is there more information in best-worst choice data? Using attitude heterogeneity structure to identify consumer segments. *International Journal of Wine Business Research* 21, 21-40.

Onozaka, Y. and D. Thilmany McFadden, 2010. Defining sustainable food market segments: do motivations and values vary by shopping locale? *American Journal of Agricultural Economics*; doi:10.1093/ajae/aaq152

Santimanon, T. and Weatherspoon, D., 2010. Hedonic Analysis of sustainable food products. *International Food and Agribusiness Management Review* 13, 57-74.

Tonsor, G., and Shupp, R., 2009. Valuations of 'sustainably produced' labels on beef, tomato, and apple products. *Agricultural and Resource Economics Review* 38, 371-383.

Umberger, W.J., D.M. Feuz, C.R. Calkins, and K. Killinger-Mann, 2002. Consumer preference and willingness to pay for domestic corn-fed beef versus international grass-fed beef measured through an experimental auction. *Agribusiness* 18, 491-504.

Yiridoe, E., S. Bonti-Ankomah, and R. C. Martin, 2005. Comparison of consumer perceptions and preference toward organic versus conventionally produced foods: A review and update of the literature. *Renewable Agriculture and Food Systems* 20:193-205.